CLAIMS

Having described the preferred embodiments, the invention is now claimed to be:

1. A magnetic resonance imaging method for performing multi-slice magnetic resonance imaging of a region of interest of an associated imaging subject **(16)** using a radio frequency coil **(40)** arranged to generate a B_1 magnetic field in the region of interest, the method comprising:

determining a per-slice B_1 field value for each slice that is representative of the B_1 field over a selected area of the slice;

determining an adjusted per-slice radio frequency excitation for each slice that adjusts the B_1 field value for the slice to a selected value;

acquiring magnetic resonance imaging data for each slice using the adjusted per-slice radio frequency excitation for that slice; and

reconstructing the acquired magnetic resonance imaging data into a reconstructed image representation.

2. The method as set forth in claim **1**, wherein the determining of a per-slice B_1 field value for each slice comprises:

determining the B_1 field across at least the selected area of the slice; and

computing an aggregate value of the determined B_1 field across the selected area of the slice.

3. The method as set forth in claim **2**, wherein the computing of an aggregate value comprises:

computing an average, median, or root-mean-square value of the determined B_1 field across the selected area of the slice.

4. The method as set forth in claim **2**, wherein the determining of the B_1 field across at least a selected area of the slice comprises:

computing the B_1 field numerically using a model **(40')** of the radio frequency coil **(40)** and a non-homogeneous model **(16')** of the imaging subject **(16)**, the non-homogeneous model **(16')** of the imaging subject **(16)** employing different

conductivity and permittivity values for different materials of which the imaging subject **(16)** is formed.

5. The method as set forth in claim **4**, wherein the non-homogeneous model **(16')** of the imaging subject **(16)** is a non-homogeneous model **(16')** of at least a portion of a human imaging subject **(16)**, the model **(16')** employing different conductivity and permittivity values for different types of tissue.

6. The method as set forth in claim **2**, wherein the determining of the B_1 field across at least the selected area of the slice comprises:

measuring a B_1 map of at least the selected area of the slice with one of (1) the region of interest of the imaging subject **(16)** disposed in the radio frequency coil **(40)**, (2) the region of interest of a representative distribution of imaging subjects acquired *a priori* in the radio frequency coil **(40)**, and (3) a spatially non-uniform compartmentalized phantom model of at least the region of interest of the imaging subject disposed in the radio frequency coil **(40)**.

7. The method as set forth in claim **1**, wherein the determining of a per-slice B_1 field value for each slice comprises:

determining a value of a figure of merit for each slice that is representative of the B_1 field over a selected area of the slice.

8. The method as set forth in claim **7**, wherein the determining of an adjusted per-slice radio frequency excitation for each slice comprises:

determining an adjusted radio frequency excitation for each slice that adjusts the B_1 field figure of merit to a selected value of the B_1 field figure of merit that is substantially the same for a plurality of slices for which imaging data is acquired.

9. The method as set forth in claim **1**, wherein the determining of an adjusted per-slice radio frequency excitation for each slice includes determining an adjusted radio frequency excitation for each slice that adjusts the per-slice B_1 field value to a selected value that is substantially the same for a plurality of slices for which imaging data is acquired, the method further comprising:

determining a specific absorption rate based on the adjusted per-slice radio frequency excitations; and

conditional upon the determined specific absorption rate exceeding a regulatory safety limit, repeating the determining of an adjusted per-slice radio frequency excitation for each slice using one of a lower selected value of the per-slice B_1 field value and adjustment of at least one other imaging sequence parameter to reduce the specific absorption rate.

10. The method as set forth in claim **1**, wherein the adjusted per-slice radio frequency excitations are adiabatic radio frequency excitations, and the determining of the adjusted adiabatic radio frequency excitations comprise:

for each slice, computing an adjusted adiabatic radio frequency excitation that substantially corrects for a variation of the B_1 field across the selected area of the slice to provide more uniform flip angles.

11. The method as set forth in claim **1**, further comprising:

moving the associated imaging subject **(16)** in a direction transverse to the slices, the determining of a per-slice B_1 field value, the determining of an adjusted per-slice radio frequency excitation, and the acquiring of magnetic resonance imaging data being repeated for a stationary slice position with the imaging subject **(16)** moved relative to the stationary slice position between each repetition.

12. The method as set forth in claim **11**, wherein the moving of the associated imaging subject **(16)** is one of:

in discrete steps, with the subject **(16)** motionless during each repetition of the acquiring, and

continuous, with the subject **(16)** moving during each repetition of the acquiring.

13. A magnetic resonance imaging apparatus comprising:

a main magnetic field coil **(20)** generating a main magnetic field;

magnetic field gradient coils **(30)** selectively generating magnetic field gradients;

a radio frequency coil **(32, 40)** arranged to generate a B_1 magnetic field in a region of interest of an associated imaging subject **(16)**;

a radio frequency transmitter **(50)** selectively energizing the radio frequency coil **(32, 40)**;

a radio frequency receiver **(52)** selectively sampling the radio frequency coil **(32, 40)**; and

a processor programmed to perform the method of claim **1**.

14. A magnetic resonance imaging apparatus for performing multi-slice magnetic resonance imaging of a region of interest of an associated imaging subject **(16)**, the apparatus comprising:

a radio frequency coil **(40)** arranged to generate a B_1 magnetic field in the region of interest;

a means **(82, 88, 110)** for determining a per-slice B_1 field value for each slice that is representative of the B_1 field over a selected area of the slice;

a means **(92, 112)** for determining an adjusted per-slice radio frequency excitation for each slice that adjusts the B_1 field value for the slice to a selected value;

a means **(10, 44, 46, 50, 52)** for acquiring magnetic resonance imaging data for each slice using the adjusted per-slice radio frequency excitation for that slice; and

a means **(58)** for reconstructing the acquired magnetic resonance imaging data into a reconstructed image representation.

15. The apparatus as set forth in claim **14**, wherein the means **(82, 88, 110)** for determining a per-slice B_1 field value for each slice comprises:

an electromagnetic simulator **(82)** receiving a digital model **(16')** of the region of interest and the digital model **(40')** of the radio frequency coil **(40)** and estimating the B_1 field generated across the region of interest, the digital model **(16')** of the region of interest mimicking non-uniform dielectric and conductivity properties of the region of interest.

16. The apparatus as set forth in claim **15**, wherein the electromagnetic simulator **(82)** employs a finite difference time domain algorithm.

17. The apparatus as set forth in claim 14, wherein the means (82, 88, 110) for determining a per-slice B_1 field value for each slice comprises:

a means (82, 88, 110) for determining a value of a figure of merit for each slice that is representative of the B_1 field over a selected area of the slice.

18. The apparatus as set forth in claim 17, wherein the means (82, 88, 110) for determining a value of a per-slice B_1 field figure of merit for each slice that is representative of the B_1 field over a selected area of the slice comprises:

a statistical aggregation means (88) for calculating an aggregate value representative of the B_1 field over the selected area of the slice.

19. The apparatus as set forth in claim 14, wherein the means (92, 112) for determining an adjusted per-slice radio frequency excitation for each slice comprises:

a table (92, 112) of adjusted per-slice radio frequency excitation versus slice position derived from the per-slice B_1 field values.

20. The apparatus as set forth in claim 14, further comprising:

a means (88) for determining a specific absorption rate based on the adjusted per-slice radio frequency excitations; and

conditional upon the determined specific absorption ratio exceeding a regulatory safety limit, repeating the determining of an adjusted per-slice radio frequency excitation for each slice using one of lower selected values of the per-slice B_1 field value and adjustment of at least one other imaging sequence parameter to reduce the specific absorption rate.